

Chapter IX – VMT and Emissions Impacts



VMT and Emissions Methodology

- The diverted truck VMT and added ton-miles for rail and intermodal shipments were used to estimate changes in vehicle emissions and fuel consumption.
 - Emissions reductions for trucks were calculated for reactive organic gases, carbon monoxide, nitrogen oxide, particulate matter (particles greater than 10 microns), hydrocarbons and nitrogen oxides. Rates from the Air Resources Board (ARB) were applied to the reduction in annual truck miles to develop gross emissions reductions for the entire region.
 - Rates for rail emissions were also taken from ARB data. Emissions categories for rail include carbon monoxide, particulate matter, hydrocarbons, and nitrogen oxides. Rail emissions rates are provided on a per ton-mile basis, and can be directly applied to the ton-mile estimates developed in the previous section.
 - Calculations for fuel consumption were developed based on 2000 ARB estimates. It was assumed that all diverted trucks were diesel-powered heavy-heavy or super-heavy duty trucks. This is the truck class that carries virtually all long haul freight. The diesel miles per gallon in the 2000 ARB report were multiplied by the truck VMT to estimate the amount of diesel fuel saved by the reduction in truck mileage.
 - For rail fuel consumption calculations, a report from the Energy Information Administration titled 'Rail Freight Transportation Energy Use' were used as the source for estimates of fuel consumption for added rail ton-miles. Fuel consumption estimates for rail are made in ton-miles and can be applied directly to the additional ton-miles to estimate additional fuel used by rail.

Distances to Truck and Rail Cordons

- Distances were checked for all the combinations of SCAG region centroid and regional cordon point for both truck (freeway) and rail routes.
 - As shown below, virtually all the rail distances are longer than the truck distances (the exceptions are mostly due to UP's Saugus line, which is little used and would carry few diverted moves).
 - The difference is most apparent in the Los Angeles/I-5 North combination, which also accounts for the largest single body of diverted traffic. There, the railroads must take 196-mile (average) routes out through San Bernardino and Cajon Pass to reach a common point at Mojave while trucks climb I-5 over Tejon Pass to reach Gorman in just 71 miles.
- The longer rail routes require more ton-miles to achieve the same transportation purpose, and raise the rail and intermodal emissions estimates accordingly.

Exhibit 127: Truck and Rail Cordon Distances

Truck and Rail Cordon Point Distances (Miles)										
	I-5 North		SR14		I-15 North		I-10		I-40	
	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail
Los Angeles Co.	71	196	81	78	243	283	253	247	273	255
Ventura Co.	75	272	95	96	278	360	299	324	322	331
Riverside Co.	129	149	107	145	204	236	201	200	249	208
Orange Co.	107	228	118	110	227	315	248	279	272	287
San Bernardino Co.	115	138	92	86	194	225	200	189	238	197
Victor Valley	103	99	107	153	103	159	224	293	127	149
Coachella Valley	254	215	157	163	254	302	125	112	201	274

Rail Transloading VMT Reduction Example

- A San Bernardino Co. to I-10 Region transloading diversion to rail would save 189 truck miles but incur 200 rail miles, a net increase in ton-miles. This increase must be offset by significantly lower units emissions from rail service..
- Most of the truck VMT saved would be on the less congested portions of I-10 to the east.

Exhibit 128: Rail Transloading VMT Reduction Example



Rail Transloading VMT Impacts

- VMT reductions were estimated for each combination of SCAG region segment and external region. Each mileage calculation extended only to the regional cordon.
- Since the high-volume I-5 corridor also has a shorter cordon distance (e.g. 71 miles from LA Co.) than I-15, I-10, or I-40 corridors (ranging from 243-273 miles from LA Co.), the VMT estimates are not as heavily weighted toward I-5 as the truck counts or tonnage estimates.

Exhibit 129: Rail Transloading VMT Impacts

SCAG Region	Annual Truck VMT Reduction by Cordon Point					Totals
	I-5 North	SR14	I-15 North	I-10	I-40	
Los Angeles Co.	2,244,465	1,432	3,470,820	7,164,909	1,125,296	14,006,923
Orange Co.	1,482,926	711	714,545	1,389,908	320,978	3,909,069
Ventura Co.	147,617	39	219,931	829,882	49,713	1,247,181
Riverside Co.	623,832	156	257,870	447,056	73,282	1,402,196
San Bernardino Co.	468,892	127	263,428	764,866	71,999	1,569,312
Victor Valley	210,013	23	54,399	305,327	15,538	585,300
Coachella Valley	171,788	251	150,961	124,343	22,474	469,817
Total	5,349,534	2,740	5,131,954	11,026,290	1,679,280	23,189,798

SCAG Region	Average Daily Truck VMT Reduction by Cordon Point					Totals
	I-5 North	SR14	I-15 North	I-10	I-40	
Los Angeles Co.	7,171	5	11,089	22,891	3,595	44,751
Orange Co.	4,738	2	2,283	4,441	1,025	12,489
Ventura Co.	472	0	703	2,651	159	3,985
Riverside Co.	1,993	0	824	1,428	234	4,480
San Bernardino Co.	1,498	0	842	2,444	230	5,014
Victor Valley	671	0	174	975	50	1,870
Coachella Valley	549	1	482	397	72	1,501
Total	17,091	9	16,396	35,228	5,365	74,089

Intermodal VMT Reduction Example

- An intermodal diversion from San Bernardino Co. to I-40 Region would reduce truck VMT by 228 miles (238 miles less 10 miles for drayage).
- Note, however, that the 10-mile “overlap” between over-the-road trucking and drayage is in the more congested urban portion while much of the VMT savings is in the less congested highway mileage to the northeast.

Exhibit 130: Intermodal VMT Reduction Example



Intermodal VMT Impacts

- The intermodal VMT impacts were adjusted for drayage requirements.

Exhibit 131: Intermodal VMT Impacts

SCAG Region	I-5 North	Annual Net* Truck VMT Reduction by Cordon Point				Totals
		SR14	I-15 North	I-10	I-40	
Los Angeles Co.	1,979,840	7,031	3,849,902	1,566,018	664,086	8,066,877
Orange Co.	1,446,346	3,865	892,360	337,802	135,498	2,815,871
Ventura Co.	20,717	77	163,472	114,586	30,147	329,000
Riverside Co.	481,385	702	203,803	88,511	44,420	818,821
San Bernardino Co.	394,339	656	249,525	147,499	46,736	838,755
Victor Valley	194,746	135	46,168	58,737	8,373	308,159
Coachella Valley	101,494	830	163,886	11,004	9,945	287,159
Total	4,618,867	13,296	5,569,118	2,324,158	939,205	13,464,643

* Adjusted for drayage requirements

SCAG Region	I-5 North	Average Daily Truck VMT Reduction by Cordon Point				Totals
		SR14	I-15 North	I-10	I-40	
Los Angeles Co.	6,325	22	12,300	5,003	2,122	25,773
Orange Co.	4,621	12	2,851	1,079	433	8,996
Ventura Co.	66	0	522	366	96	1,051
Riverside Co.	1,538	2	651	283	142	2,616
San Bernardino Co.	1,260	2	797	471	149	2,680
Victor Valley	622	0	148	188	27	985
Coachella Valley	324	3	524	35	32	917
Total	14,757	42	17,793	7,425	3,001	43,018

* Adjusted for drayage requirements

Combined VMT Impacts

- The combined rail transloading/carload and intermodal VMT impacts are shown below.

Exhibit 132: Combined VMT Impacts

SCAG Region	I-5 North	Annual Net* Truck VMT Reduction by Cordon Point				Totals
		SR14	I-15 North	I-10	I-40	
Los Angeles Co.	4,224,306	8,463	7,320,723	8,730,928	1,789,382	22,073,800
Orange Co.	2,929,272	4,576	1,606,906	1,727,710	456,476	6,724,940
Ventura Co.	168,335	116	383,403	944,468	79,860	1,576,181
Riverside Co.	1,105,217	858	461,674	535,566	117,702	2,221,017
San Bernardino Co.	863,231	783	512,953	912,366	118,735	2,408,067
Victor Valley	404,759	158	100,567	364,063	23,911	893,459
Coachella Valley	273,281	1,081	314,847	135,347	32,420	756,976
Total	9,968,401	16,036	10,701,072	13,350,448	2,618,485	36,654,441

* Adjusted for drayage requirements

SCAG Region	I-5 North	Average Daily Net* Truck VMT Reduction by Cordon Point				Totals
		SR14	I-15 North	I-10	I-40	
Los Angeles Co.	13,496	27	23,389	27,894	5,717	70,523
Orange Co.	9,359	15	5,134	5,520	1,458	21,485
Ventura Co.	538	0	1,225	3,017	255	5,036
Riverside Co.	3,531	3	1,475	1,711	376	7,096
San Bernardino Co.	2,758	3	1,639	2,915	379	7,694
Victor Valley	1,293	1	321	1,163	76	2,855
Coachella Valley	873	3	1,006	432	104	2,418
Total	31,848	51	34,189	42,653	8,366	117,107

* Adjusted for drayage requirements

Emissions Parameters

- OTR truck emissions vary with driving conditions
- Line-haul rail emissions are generally much lower than OTR truck, but intermodal NOx emissions are higher
- The longer rail hauls noted earlier reduce rail's emissions advantage.

Exhibit 133: Emissions Parameters

Sample Emissions Comparison: Grams per Net Ton-Mile

Truck*	1999				2020			
	CO	NOx	CO2	PM10	CO	NOx	CO2	PM10
Los Angeles	0.392	1.278	0.143	0.057	0.143	0.498	0.144	0.031
Orange	0.304	1.204	0.143	0.049	0.141	0.503	0.144	0.029
Riverside	0.324	1.236	0.141	0.050	0.146	0.504	0.142	0.019
San Bernardino	0.344	1.253	0.142	0.053	0.142	0.504	0.143	0.030
Average	0.366	1.259	0.143	0.054	0.143	0.499	0.144	0.030
* example at 15 net tons per vehicle								
Rail	1999				2020			
	CO	NOx	HC	PM	CO	NOx	HC	PM
Carload	0.075	1.039	0.03	0.027	0.061	0.427	0.018	0.016
Intermodal	0.106	1.44	0.041	0.037	0.086	0.591	0.025	0.022
Local	0.195	2.45	0.078	0.062	0.158	1.006	0.047	0.036

Combined Emissions Impacts

- The combined rail carload and intermodal diversion VMT and ton-mile changes were used to estimate the net change in comparable emissions factors. Note that not all of the factors listed could be estimated for both modes from the available literature.
- The factors located and used for this study, when applied to the diversion estimates, indicate a net decrease in CO and PM10/PM emissions, but higher NOx emissions.

Exhibit 134: Combined Emissions Impacts

	1999/2000 Emissions Impacts				
	Truck Reduction	Drayage Increase	Rail IM Increase	Rail Carload Increase	Net Change
ROG	93,702	4,930	na	na	na
CO	434,817	22,875	77,892	71,756	(262,294)
NOx	1,496,531	78,731	1,058,154	994,058	634,412
CO2	169,567	8,921	na	na	na
PM10/PM	64,529	3,395	27,189	25,832	(8,113)
HC	na	na	30,128	28,702	na